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ART. XIII.—*Records and Descriptions of some Australian Devonian Fishes.*

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The palaeontological material described in this paper comprises several noteworthy specimens of Devonian fishes from the following districts:—Buchan, Victoria (Middle Devonian); Gilberton, Queensland (Middle Devonian); Mansfield, Victoria (Upper Devonian); and Hervey's Range, N.S.W. (Upper Devonian). The record of Upper Devonian fishes from near Mansfield is particularly interesting, as the presence of an Upper Devonian series in this district had not been suspected previous to the discovery of the fishes by Mr. H. B. Hauser.

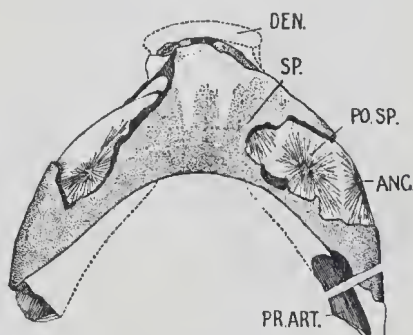
LOCALITY 1.—BUCHAN, VICTORIA.

Horizon.—Middle Devonian (marine limestones).

Material.—The lower jaw of a large Dipnoan. Preserved in the National Museum, Melbourne, Register No. 13837. Exact locality unknown.

TEXT-FIGURE 1.

Lower jaw of a large Dipnoan. Middle Devonian, Buchan, Victoria. $\times 1/3$. *Ang.*, angular; *den.*, dentary; *pr. art.*, pre-articular; *po. sp.*, post-splenial; *sp.*, splenial. The broken lines suggest the probable outlines of missing parts.



The specimen has been determined in a provisional way by Mr. Chapman, as probably referable to *Dipnorhynchus*, a Dipnoan occurring also in the Middle Devonian limestones of Taemas, N.S.W. (Hills, 1933.)

Description.—The specimen consists of a large lower jaw, 14 cm. wide between the articulators, which has been freed from the matrix on its underside, but whose inner parts are still embedded in hard limestone. The underside of the jaw was originally covered with thick cosmoid bone, but this has been partly broken away, exposing a cast of the inner surface. This cast shows the impression of grooves radiating from the growth centres of the dermal bones (Fig. 1), which enables the individual bones to be identified, although no trace of sutures is visible on the exterior. Most of the upper surface of the jaw, and also the dentary and the articular parts of the rami, are missing.

Compared with its width, the jaw is relatively very short, the estimated length being 12 cm., and the width 14 cm. This fact, together with the robustness of the jaw, the absence of pointed teeth, and the shape and arrangement of the dermal bones, leave no doubt that the jaw is that of a large Dipnoan, from which the dental plates are missing. In its osteological characters, it is very similar to the lower jaw of *Dipterus platycephalus* (Ag.), the description of which by Watson and Gill (1923) has been followed with regard to the nomenclature of the bones.

Anteriorly, it is clear that a dentary was formerly present (Fig. 1), posteriorly to which are paired bones whose surface is smooth in front and punctate behind. These are the splenials. Between these bones and the angulars, which form the outer surface of the jaw, are the post-splenials. The shape of the articulars and pre-articulars cannot be made out, owing to the incompleteness of the articular parts of both rami and the presence of matrix between them, but a cross section which has been cut across the left ramus at some time, allows the histological structure to be determined (Fig. 2). It may be seen



TEXT-FIGURE 2.

Section across the left ramus of the Dipnoan from Buchan. Approximately natural size. *Ang.*, angular; *art.*, articular; *can.*, canal; *pr. art.*, pre-articular. Note the contrast between the spongy replacement bone and the dense dermal bones.

that between the dense angular and pre-articular dermal bones there is a mass of spongy bone, which represents an articular ossification of the posterior parts of Meckel's cartilage, and that a large canal runs forwards between the angular and the articular, probably opening anteriorly into the supra-Meckelian vacuity.

In size, robustness, and tendency to fusion of the dermal bones, the specimen resembles *Dipnorhynchus*, but the lower jaw of that genus is unknown, and the absence of dental plates in the specimen under consideration makes comparison with other genera difficult, so that its generic position is, I think, uncertain. It is interesting, however, to note the presence of these large Dipnoans in marine Middle Devonian limestones at both Buchan and Taemas.

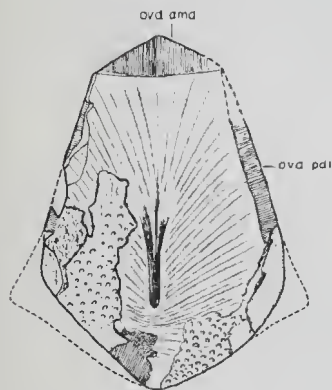
LOCALITY 2.—GILBERTON DISTRICT, QUEENSLAND.

Horizon.—Middle Devonian (*vide* Dr. F. W. Whitehouse).

Material.—An imperfect Antiarchan posterior median dorsal plate, associated with plant remains.

This plate was obtained by Dr. F. W. Whitehouse, who kindly sent me a plaster cast of it, the specimen itself being attached to a large block of stone. It is preserved mainly as a mould of the interior of the plate, with part of the bone still adhering in places.

Description.—The plate is 8 cm. long and approximately 5.6 cm. wide at the widest part, where it is probably incomplete. Anteriorly and laterally, the areas of overlap on to the anterior median dorsal and posterior dorso-laterals are clearly shown, the posterior edge being free (Fig. 3). The usual median ridge for



TEXT-FIGURE 3.

Posterior median dorsal plate of an Antiarchan. Middle Devonian, Gilberton District, Queensland. $\times \frac{1}{2}$. *Ovd. amd.*, area overlapping on to the anterior median dorsal plate; *ovd. pdl.*, area overlapping on to the right posterior dorso-lateral plate. The broken lines represent the probable outlines of missing parts.

the attachment of the soft parts is present on the underside, and also the internal rounded transverse ridge bordering the posterior opening of the body carapace. The ornament consists of low rounded tubercles joined by anastomosing ridges.

Owing to the absence of diagnostic features, generic determination of this specimen is not possible, although its Antiarchan characters are obvious. This is the first record of Antiarchan from the Middle Devonian of Australia, and it would be interesting to know the genus represented, but this determination must wait upon the discovery of further material.

LOCALITY 3.—MANSFIELD, VICTORIA.

Horizon.—Upper Devonian.

Material.—Fragmentary remains of placodermatous fishes, preserved as moulds in siliceous sandstone which fractures in a very irregular manner. The fossils were studied by cleaning away any remaining bone, and also iron oxide incrustations, with hydrochloric acid.

The collection was made by Mr. H. B. Hauser, from Allotment 75A, Parish of Loyola, at the summit of the western flank of the South Blue Range, and is now preserved in the museum of the Geology Department, University of Melbourne.

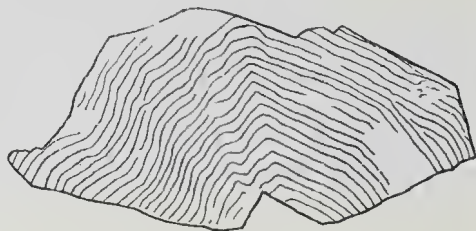
Genus *Phyllolepis*.

Description.—Some of the plates from Mansfield exhibit the meandrine surface ornament characteristic of the *Phyllolepidae* (Fig. 4), but none of the fragments preserved can be matched with certainty with any individual plate of the carapace of

TEXT-FIGURE 4.

Phyllolepis sp. Upper Devonian, South Blue Range, near Mansfield, Victoria. Perhaps a portion of one of the anterior ventral plates.

× 2/3 approximately.



Phyllolepis. Up to the present, this uncertainty has also existed in the case of the *Phyllolepidae* from the Upper Devonian of Taggerty, and some doubt might have been entertained as to the systematic position of these presumed *Phyllolepid* remains, especially as their histological structure (Hills, 1931, p. 213) appeared to differ from that of *Phyllolepis* plates as described by Gross (1934) and Stensiö (1934). Any doubt as to the generic identity of the remains from Taggerty is now removed by the discovery of a plate (Pl. XII., Fig. 1) which can be identified by means of Stensiö's descriptions, as a left posterior ventro-lateral. Another plate, one of the original collection, may now also be matched with a plate of unknown position, referred by Stensiö to *Phyllolepis* (Stensiö, 1934, Pl. 1, Fig. 1). Furthermore, one of the plates formerly figured by me (Hills, 1931, Fig. 2, No. 1), in all probability represents a lateral posterior part of a median cephalic plate, as the sharp flexure of the ornament seen in the fragment is characteristic of these plates in *Phyllolepis* species.

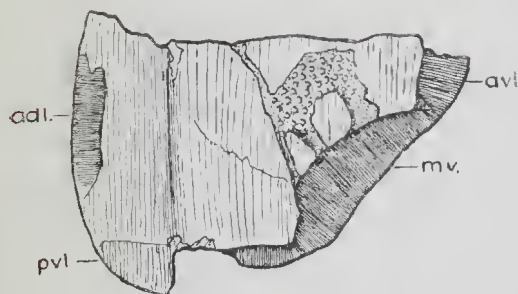
It is clear, therefore, that the plates from Taggerty are referable to *Phyllolepis* as the genus is at present constituted, and the apparent absence of bone cells in these plates, as formerly reported, is certainly due to the poor state of preservation, which does not allow them to be identified.

The plates obtained from Mansfield, owing to their characteristic ornament and extreme thinness, may be referred to *Phyllolepis* also, and it is possible that the specimen figured (Fig. 4) represents a part of one of the anterior ventral plates.

Genus **Bothriolepis**.

Description.—Certain of the plates from Mansfield are definitely Antiarchan, one (Fig. 5) being recognizable as the

TEXT-FIGURE 5.



Bothriolepis sp. Upper Devonian, South Blue Range, near Mansfield, Victoria. Posterior portion of a right anterior ventro-lateral plate. Slightly reduced. *Adl.*, area overlapping on to the right anterior dorso-lateral plate; *avl.*, area overlapping on to the left anterior ventro-lateral plate; *mv.*, area overlapping on to the median ventral plate; *pvl.*, area overlapping on to the right posterior ventro-lateral plate.

posterior portion of a right anterior ventro-lateral plate, of moderately large size. There are also two fragments of pectoral appendages, which are definitely of the *Bothriolepis* type, and may provisionally, in the absence of more complete specimens, be referred to that genus. One of these specimens (Pl. XII., Fig. 3) consists of portion of the proximal part of the fin, including the joint with the distal part. A small subtriangular anconeal plate is present, showing the "Siebknochen" structure characteristic of joint surfaces in the Antiarchi. The arrangement of the ornament on the adjacent plates, as well as the traces of sutures, enable the form of the external and internal marginals to be made out, leaving no doubt that the arrangement of the plates is that typical of the dorsal surface of the pectoral fin of *Bothriolepis*. The ornament, which resembles that on the anterior ventro-lateral above referred to, is similar to that of the larger *Bothriolepis* species, and on the outer edge of the external marginal in the second fragmentary fin from this locality, is an enlarged series of tubercles.

Remarks.—The presence of *Phyllolepis* and *Bothriolepis* in the collection obtained from the South Blue Range definitely indicates the age of the beds in which they occur to be Upper Devonian, since both these genera are, so far as is known, restricted in their occurrence to that series. Upper Devonian rocks have not previously been recognized in the Mansfield district, although, as is well known, an extensive Lower Carboniferous fish fauna has been obtained from a locality which is usually referred to simply as "Mansfield," but which is actually about six miles north of the town, near the junction of Bridge

Creek with the Broken River. The Upper Devonian fish, on the other hand, were found about two miles to the south of Mansfield.

Pending further investigation of the stratigraphical relationships of these Upper Devonian and Lower Carboniferous beds, which is being undertaken by Mr. Hauser, it may be indicated that the discovery of Upper Devonian fishes in the South Blue Range in no respect invalidates the conclusion reached by Smith Woodward (1906), that the fish fauna from Bridge Creek is Lower Carboniferous. The Upper Devonian beds in the South Blue Range definitely underlie the Lower Carboniferous, forming the base of a thick series of Upper Palaeozoic sediments which occupies the Mansfield basin, and the stratigraphical sequence at Mansfield is now seen to agree in general with that established for the southern parts of the Eastern Upper Palaeozoic Belt (Hills, 1931), viz.:—

Lower Carboniferous—

Sandstones, conglomerates, &c., without interbedded lavas.
Conformity.

Upper Devonian—

Sandstones, conglomerates, &c., usually with interbedded acid to basic lavas.
Unconformity.

Plant remains, some of which are well preserved and show details of histological structure, are associated with the Upper Devonian fishes at the South Blue Range, and there are also in the collection some plates whose ornament is quite distinct from that of *Phyllolepis* or *Bothriolepis*, but which are too fragmentary for determination.

LOCALITY 4.—HERVEY'S RANGE, N.S.W.

Horizon.—Upper Devonian.

Material.—Mould, in sandstone, of a Dipnoan dental plate. Preserved in the Museum of Comparative Zoology at Harvard, Register No. 5285.

This specimen was collected from the Gingham Gap, Hervey's Range, by Mr. W. E. Schevill, of the Museum of Comparative Zoology at Harvard. Photographs of the dental plate were very kindly sent to me, and permission to record the discovery granted. I am also indebted to Mr. Schevill for the loan of the *Phyllolepis* plate from Taggerty, figured herewith as Pl. XII., Fig. 1.

Genus **Dipterus** Ag.

(Pl. XII., Fig. 4.)

Description.—The dental plate, which is sub-triangular, bears seven denticulate comb ridges radiating from a point, in the manner characteristic of *Dipterus*. The shape of the specimen

suggests that it is one of the palatine plates (the right). The pattern of the comb ridges is quite distinct from that in the palatine plates of *Dipterus microsoma* Hills, from Taggerty, and it is therefore probable that a new species of *Dipterus* is represented, although sufficient diagnostic characters to enable it to be erected are not represented.

The recognition of *Dipterus* in the Upper Devonian of Hervey's Range is an interesting addition to the list of fishes already recorded from this locality (see Hills, 1932).

Conclusion.

In view of the recent advances that have been made in our knowledge of the Devonian fishes of Australia, it may be useful to summarize the information now available concerning the occurrence of these forms. In addition to the genera cited in the following list, fragmentary material, incapable of precise determination, but in some cases clearly distinct from the forms mentioned, has been obtained from several of the localities given, as well as from others not referred to. An indeterminate placodermatous plate, perhaps belonging to an Arthrodire, has been obtained from the Upper Devonian of the Napier Range, Kimberley District, W.A. (Woodward, in Glauert, 1910, p. 113), and a form stated to be allied to *Macropetalichthys* is reported to occur in beds probably of Middle Devonian age at Goodra Vale, N.S.W. (Woodward, 1916). I have also examined a fish plate from Coradgery, N.S.W. (Geol. Surv., N.S.W., No. F. 5720) which is referable to *Phyllolepis*, and is therefore in all probability of Upper Devonian age.

These forms, together with those listed below, comprise all the Devonian fishes so far recorded from Australia.

UPPER DEVONIAN.

Blue Hills, near Taggerty, Vic. (Hills, 1931).—*Bothriolepis gippslandiensis* Hills; (?) *Remigolepis* sp.; *Phyllolepis* sp.; *Dipterus microsoma* (Hills).

Freestone Creek, near Briagolong, Vic. (Hills, 1931).—*Bothriolepis gippslandiensis* Hills; *Striacanthus sicaeformis* Hills; (see Note 1).

South Blue Range, near Mansfield, Vic.—*Bothriolepis* sp.; *Phyllolepis* sp.

Hervey's Range, near Parkes, N.S.W. (Hills, 1932).—*Bothriolepis* sp.; *Remigolepis* sp.; *Phyllolepis* sp.; (?) *Striacanthus* sp.; *Dipterus* sp.; (?) *Holoptychius* sp.; (see Note 2).

Canoblas Mts., N.S.W. (Hills, 1932).—*Bothriolepis* sp.

Jemalong Gap, near Forbes, N.S.W. (Hills, 1932).—(?) *Gyroplacosteus* sp.; (see Note 3).

MIDDLE DEVONIAN.

Buchan, Vic.—*Coccosteus osseus* Hills; Dipnoan, (?) genus; (see Note 4).

Taemas, N.S.W. (Hills, 1933).—*Dipnorhynchus süssmilchi* (Etheridge fil.).

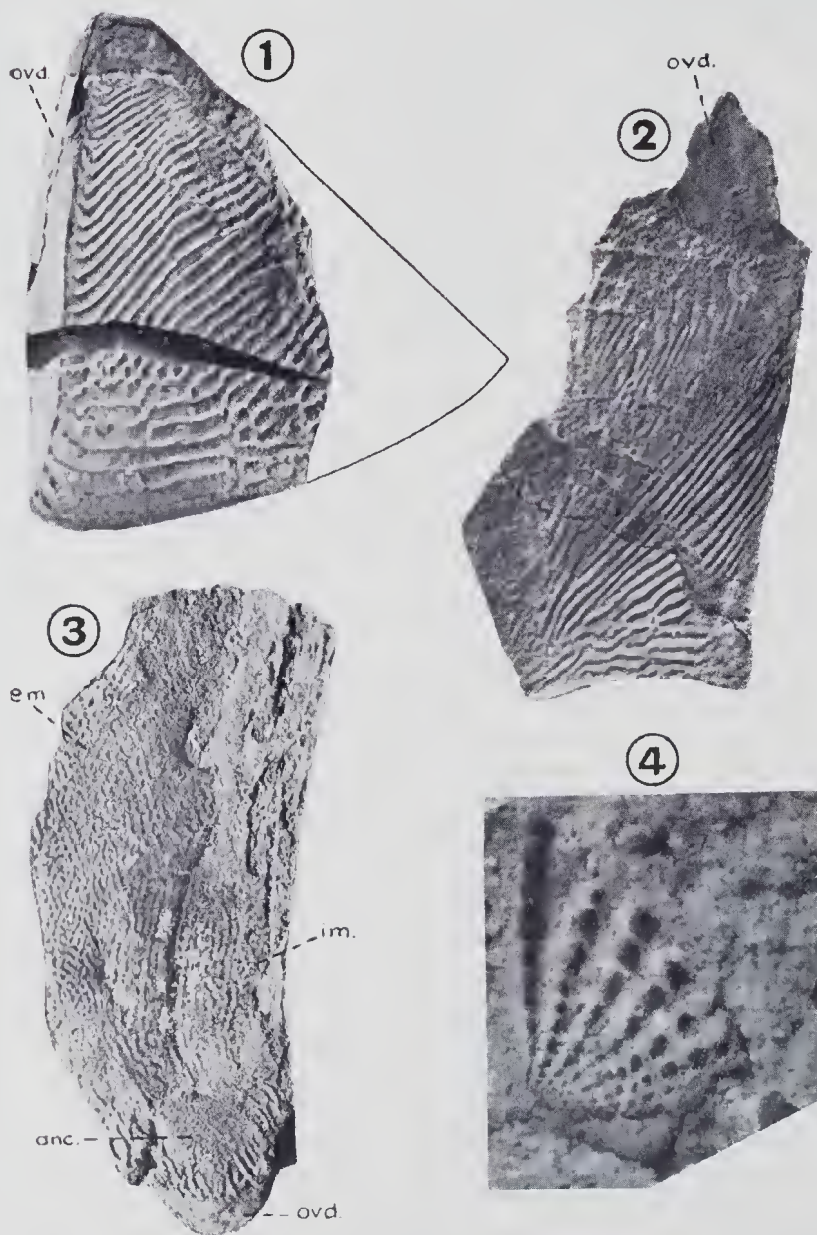
Gilberton District, Queensland.—*Antiarchan*, (?) genus.

NOTES.—(1) In a review of my paper (1931) on the Upper Devonian fishes of Victoria, Gross (1932) has written, with regard to the genus *Striacanthus* Hills, that "the finspines belong to the genus *Onchus*, of which the author has obviously not thought, and resemble the *Onchus* spines from the Baltic and American Devonian" (translation). It is true that in their general external form, *Striacanthus* spines resemble those of *Onchus*, but in the latter genus the base of insertion is smooth, or at most, marked with extremely fine striae (see Gross, 1933, Pl. 2, Fig. 6), while in *Striacanthus* it bears a very distinct longitudinal ribbing. Of more importance, however, is the histological structure. In *Striacanthus* there are several small canals running through the spine parallel to the large central pulp cavity, and this structure is not shown by any *Onchus* spine known to me (see the figures given by Gross, 1933, and Rohon, 1893). I therefore maintain that *Striacanthus* and *Onchus* may be considered as generically distinct.

(2) In view of the very fragmentary nature of the remains from Hervey's Range previously referred by me to *Striacanthus* and *Holoptychius*, some doubt may legitimately be entertained as to the correctness of these determinations. This is indicated in the list by notes of interrogation.

(3) The impression of a very large dermal plate from the Jemalong Gap, previously recorded (Hills, 1932, p. 852) as "suggestive of a very large *Bothriolepis*," bears a striking resemblance in size and ornament to the dermal plates of the genus *Gyroplacosteus*, recently erected by Obrutschew (1933). The two species of this genus described by Obrutschew both occur in the Upper Devonian of districts bordering the Sjass River, in Russia.

(4) Re-examination of the specimen from Buchan, previously referred by Chapman (1916) to *Phlyctaenaspis*, makes it clear that this is really *Coccosteus*. It will be described by me as a new species, *C. osseus*, in a forthcoming paper.



Devonian Fish Remains.

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Explanation of Plate.

- Fig. 1.—*Phyllolepis* sp. Upper Devonian, Blue Hills, near Taggerty, Victoria. Impression of an imperfect left posterior ventro-lateral plate. $\times 4/3$. The line indicates the probable outline of the complete plate. *ovd.*, area overlapping the left anterior ventro-lateral plate. *Museum of Comparative Zoology, Harvard, U.S.A., Reg. No. 5276.*
- Fig. 2.—*Phyllolepis* sp. Upper Devonian, Blue Hills, near Taggerty, Victoria. $\times 2$ approx. Plate of unknown position, similar to that figured by Stensiö (1934), Pl. 1 Fig. 1. *Department of Geology, University of Melbourne, Reg. No. 791.*
- Fig. 3.—*Bothriolepis* sp. Upper Devonian, South Blue Range, near Mansfield, Victoria. Impression of the dorsal surface of an imperfect right pectoral fin. Approx. nat. size. *Anc.*, anconeal plate; *em.*, external marginal plate; *im.*, internal marginal plate; *ovd.*, area overlapped by the distal part of the fin. *Department of Geology, University of Melbourne, Reg. No. 1588.*
- Fig. 4.—*Dipterus* sp. Gingham Gap, Hervey's Range, near Parkes, N.S.W. Impression of a right palatine dental plate. $\times 5$. *Museum of Comparative Zoology, Harvard, Reg. No. 5285.*